INDUSTRIAL SOLUTIONS LABORATORY

Company Information

Company Name	*Carrier Corporation*	**Date Submitted**	*05/10/2022*
Project Title	*Development of a Universal Water Box Hinge Replacement* **(CARR_HINGE)**	**Planned Starting Semester**	*Fall 2022*

Senior Design Project Description

Personnel

Typical teams will have 4-6 students, with engineering disciplines assigned based on the anticipated Scope of the Project.

Please provide your estimate of staffing in the below table. The Senior Design Committee will adjust as appropriate based on scope and discipline skills.

Discipline	Number	Discipline	Number
Mechanical	5	Electrical	
Computer		Systems	

Company and Project Overview:

Carrier is a world leader in high-technology heating, air-conditioning and refrigeration solutions. Carrier provides products for HVAC building systems worldwide.

Built on Willis Carrier's invention of modern air conditioning in 1902, Carrier is a global leader in heating, air-conditioning and refrigeration solutions. In addition to the familiar residential products, Carrier has a vast array of heavy capacity commercial products for buildings and high-rises of all types. These sophisticated units contain a wide variety of technologies including air handlers, air/water chillers, sensors and building automation controls.

The 9701 Old Statesville Rd Charlotte NC Carrier facility contains design engineering, test engineering and manufacturing operations. Some product examples are shown below:

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The Carrier Charlotte factory manufactures commercial water-cooled chillers. Each chiller can be customized to meet customers specific needs. A commonly ordered option is a hinged water box cover (shown below). The hinge allows maintenance technicians to remove the water box cover to service the inside of the waterbox. Hinges are often requested when customers do not have lifting equipment or space for lifting equipment in their mechanical rooms.

Due to the large variety of chiller customizations offered, hinge designs are specific to each water box size and arrangement. This adds complexity in the design and manufacturing process.
The objective of this project is to design a single device/design to functionally replace the hinge design, reducing complexity and saving design resources.

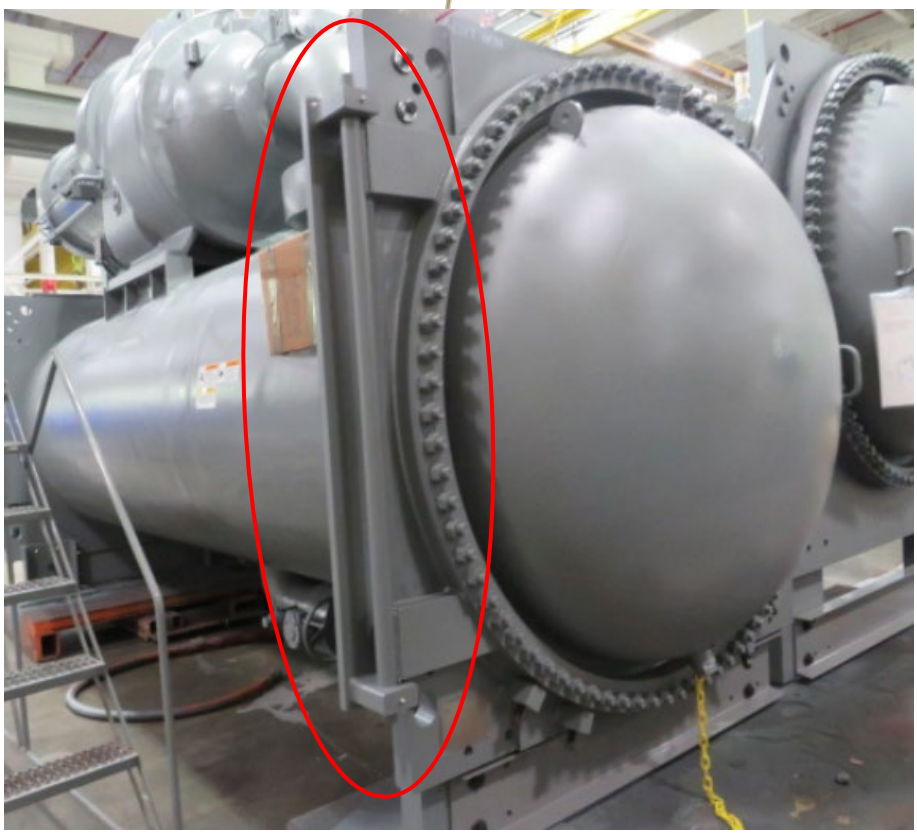

Figure 1: Dished-Head Waterbox Hinge Configuration Example

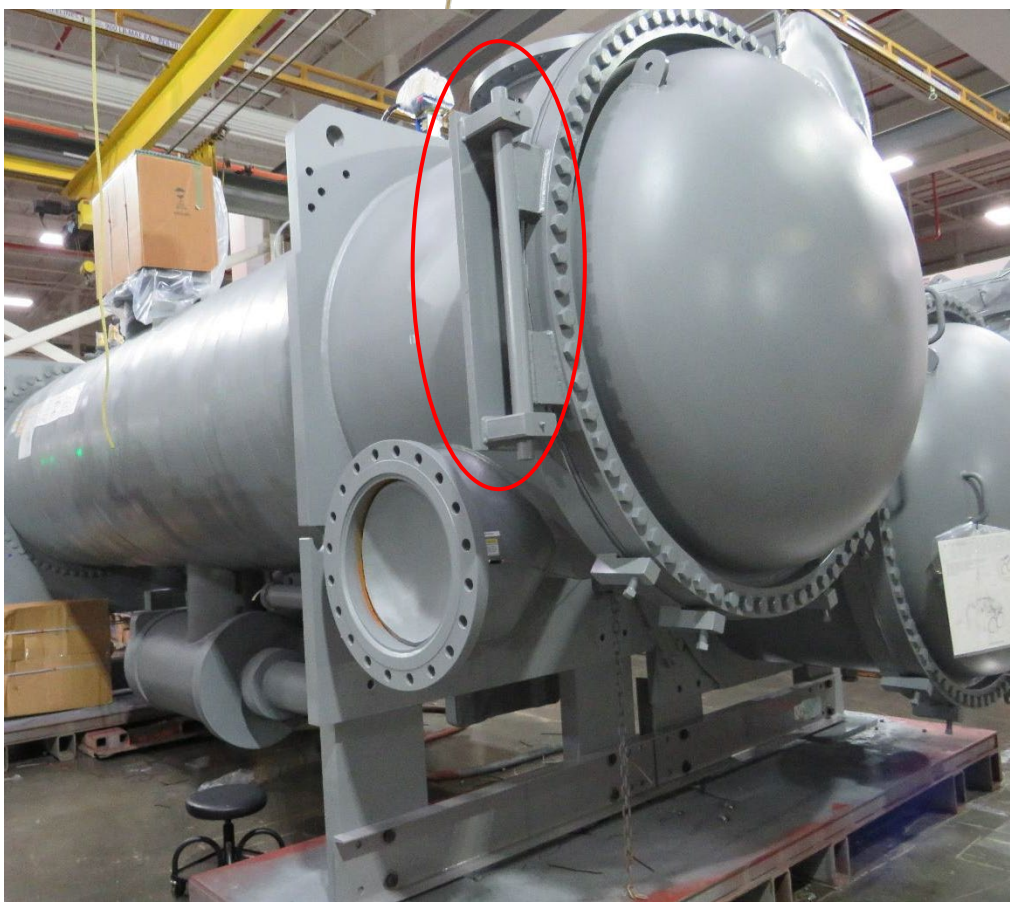

Figure 2: Marine Waterbox Hinge Configuration Example

Project Requirements:

The team will investigate, design, build/purchase, and test a unit mounted device capable of safely maneuvering waterbox covers for the 19XR6 & 7 water-cooled chillers and their configurations.

The new design will need to meet the following requirements:

- Design should be able to maneuver water box covers up to 5500 lbs. with an appropriate safety factor
- Single design that is compatible with multiple frame sizes and configurations
- Design should ideally have a bolt on connection that is compatible with the existing bolt mounting locations, or some other means of installation other than welding.
- Design should be compact and ideally fit within chiller envelope
- Design should be easily operated by service technicians

Expected Deliverables/Results:

- A report out of the project either electronically or hard copy.
- Prior art investigation (patents)
- Cost analysis

- Manufacturing analysis (Make or buy)
- 3D CAD models
- Hand calculations
- Finite element analysis (FEA)
- FEA validation through strain gauge testing
- 3D printed scale models

Disposition of Deliverables at the End of the Project:

Students are graded based on their display and presentation of their team's work product. It is mandatory that they exhibit at the Expo, so if the work product was tested at the supporter's location, it must be returned to campus for the Expo. After the expo, the team and supporter should arrange the handover of the work product to the industry supporter. This handover must be concluded within 7 days of the Expo.

List here any specific skills, requirements, specific courses, knowledge needed or suggested (If none please state none):

- Finite Element Analysis
- Travel to the Carrier Facility in Charlotte, NC. Mileage will be reimbursed per ISL purchasing procedures.